Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Three hundred and sixty-ninth meeting.

October 12, 1852. — Monthly Meeting.

The President in the chair.

The President, in behalf of the committee appointed to provide for the delivery of the Academy's course of lectures, reported that the requisite arrangements had been completed. The course was given as follows, commencing on Wednesday evening, October 27th, at half past seven o'clock, and continued on successive Wednesday evenings: —

By Jacob Bigelow, M. D., President, Introductory Lecture.

By Professor L. Agassiz, Genealogy of the Animal Kingdom.

By Professor C. C. Felton, Relation of Aristophanes to his Times.

By George Ticknor, Esq., The Tartuffe of Molière.

By Dr. B. A. Gould, Jr., The Theory of Probability.

By Daniel Treadwell, Esq., The Progress of the Useful Arts, and their Relation to Scientific Discovery.

By President Edward Hitchcock, The Bird Traces of Connecticut River.

By Lieutenant Charles H. Davis, Astronomical Prediction.

By Professor C. C. Felton, Aristophanes, Second Lecture.

By Professor Albert Hopkins, Time.

By Oliver Wendell Holmes, M. D., The Relations of Poetry and Science.

By George B. Emerson, Esq., A Higher Course of Instruction in Science in Reference to Preparation for exercising the Useful Arts.

By Hon. Samuel A. Eliot, A Complete System of Public Education.

Mr. Horsford exhibited to the Academy specimens of his newly invented safety-lamp and safety-can, and described the precautions which had been taken to guard against accidents.

Dr. W. I. Burnett read a paper upon Cartilaginous and Osseous Tissues.

"The cartilaginous tissue, wherever found, is invariably the same.

Two varieties, however, dependent upon degree of organization, are met with : —

" The first is *cellular cartilage*, being of a transient nature, ultimately to be changed into bone. It is composed of nucleated, well-defined cells lying in a semi-solid, punctiform stroma.

" The second is *fibro-cartilage* of a permanent nature, and consisting of the same cells as the first, but which lie in a network of fibrous tissue, which last is only a further developed condition of the punctiform stroma.

" In fibro-cartilage the fibrous tissue may so increase at the expense of the cellular elements, that these last almost entirely disappear, and hence the transition of fibro-cartilage into fibrous tissue.

" From this it will appear that all cartilage is originally the same, that is, *cellular*, appearing as such in the embryo.

" Its formation there, according to my own observation, occurs in the following manner.

" At those points where cartilage and afterwards bone is to appear, there are seen cells which, as to physical characteristics, cannot be distinguished from those which are to form other tissues.

" A part of these cells are condensed into a punctiform stroma, leaving open spaces here and there, in which the original cells in numbers from one to four remain. Thus is ultimately seen a finely granular stroma, inclosing free nucleated cells. This is the true *cellular cartilage.*

" As this stroma is formed closely about the cells, it is not correct to say that cavities are formed in it, and in which the cells lie. For the cell-membrane, lying in direct contact with the stroma, blends with it, the *nuclei* alone, therefore, being left in the cavity ; but as these are nucleolated, they resemble cells, and should be thus designated.

" In *fibro-cartilage* the same early changes occur, but the stroma is further developed into a fibrous or fibrillated tissue. Where this has occurred, the cell-nuclei lie in nidiform cavities.

" Cellular cartilage alone is developed into bone. This occurs in the following manner. When the ossific matter is about to be deposited, the vascularity of the cartilage is much increased, having a pinkish hue. Then a kind of liquefaction of the stroma intervening the cells takes place, by which the cartilage-cells appear no longer confined irregularly, but are, for the most part, free to assume any relative position. Soon after this, there is seen with them a tendency to an arrangement in a linear series. The rows thus formed run parallel with the long diameter of the bone, and are separated from each other by the intercellular matrix, which consists of the partially liquefied stroma.

" It is thus that the future bone may be said to consist of a fasciculus of tubes filled with cartilage cells. This intercellular matrix constitutes the primitive ossific rete, in which the calcareous salts are first deposited. This first deposition having taken place, the cartilage-cells are situated in cup-like, or rather cylinder-like, cavities.

" During this time, however, the cartilage-cells, and the substance immediately surrounding them, are likewise changed from the presence of calcareous matter.

" The cells become smaller, and, in contracting, assume irregular forms, and the septa separating the tubes in which they formerly lay become more and more indistinct from the fulness of the calcareous deposition. Finally, a grayish mass is perceived, having little regularity, and variegated in aspect by the presence of strangely shaped bodies, the future Purkinjean corpuscles. But these processes should be described a little more minutely. During the calcareous deposition, the aqueous portion of the tissue disappears, and, the size of the whole being reduced, the cartilage-cells are brought nearer together; the tissue, therefore, is much more compact, but has not lost its original characteristics. The tubes of which we have spoken form the *concentric lamellæ*, in which the corpuscles are regularly arranged; and thus a transverse section shows them to be *solid cylinders* instead of *hollow tubes* as before the calcareous deposition.

" *The cartilage-cells are transformed into the Purkinjean or osseous corpuscles.* This I have clearly observed, and have traced all the phases of the change. Where the cells are in the cup-like cavities, their nuclei are prominent. But as ossification proceeds they gradually crumble away, and by the time ossific matter is deposited in the cell-walls, little of them can be seen. The cells, however, remain in a shrunken state, holding a concentric relation to a continuous cavity of the tube, and which cavity is the Haversian canal. When the cartilage-cells begin to shrink, radiating lines are seen running from each, and in reaching out in every direction, they meet and join those of contiguous cells, and thus a connection is formed on every side.

" The question now arises, What are these canaliculi? Are they, according to Schwann, prolongations of the cartilage-cell membrane;

or, according to Owen and others, radiations of its nucleus? My own opinion is different from either, and for the following reasons. In the first place, the canaliculi do not begin to form until calcareous matter is deposited, and, as the cell-membrane is then either filled with calcareous matter, or partially absorbed, it could not well send out prolongations. Moreover, these last are often of such a length, and so branch and rebranch upon themselves, that such a mode of formation seems hardly possible. To me it appears most probable that they are the channels of escape of aeriform matters from the interior of the cell. For the cell, situated in the midst of an ossifying mass, would retain for some time its animal matter, and this last would ultimately give rise to gases seeking their escape in every direction by percolating the surrounding semi-solid mass. Canaliculi would thus be formed, and these, converging towards the nearest outlet, have therefore been rightly called 'converging tubuli.'

"During these phases of formation, some of the nuclei of the cartilage-cells, or even whole other cells of a small size, may not be dissolved, but become ossified as such. They are then found as cell-like corpuscles scattered through the osseous tissue. It is in this way that I account for the occasional presence, in the spongy tissue of the long bones, of small spherical bodies, first discovered in 1849 by Dr. O. W. Holmes of this city.

"Such appear to be the processes of formation of the compact tissue of the bones of the higher Vertebrata, as I have studied them in fœtal goats.

"The whole process is simply one of *substitution*, with that contraction and modification of form which necessarily ensues when a soft is replaced by a sclerous tissue.

"This process of substitution is carried out everywhere the same, there being, however, variations in some steps of its progress in the different kinds of bones. The spongy nature of the internal or middle portions of some bones appears to be produced by the absorption, by numerous vessels there situated, of the lighter portion of the primitive cartilaginous base, and a consolidation of the remaining portion towards the periphery.

"This is a point, however, having an unusual teleological bearing, for by such process bones possess the greatest combined strength and lightness attainable with the same amount of material.

"These phases of formation just described belong especially to the higher Vertebrata. In the lower classes they are of a much less complicated character. Thus in many fishes the *concentric lamellæ* do not exist, and therefore there has been no linear arrangement of the cartilage-cells. But these cells are ossified *in situ*, and their canaliculi, radiating thence on every side, give to the whole a most regular and beautiful appearance.

" The cartilage of the cartilaginous fishes seems to differ from the common cartilage of the higher Vertebrata. In fact, it cannot be called true cartilage, but is, if I may so express myself, an osseous tissue in a cartilaginous dress.

" This may be explained by a few remarks. Valenciennes* has shown that the cartilage of the cartilaginous fishes and of the Cephalopoda contains *gelatine*, and not *chondrine.*

" Müller † has also shown that all cartilage capable of ossification contains *chondrine*, and not *gelatine*, and that after ossification no *chondrine* is found, but all is *gelatine.* Therefore bones are, so to speak, gelatinous, and not *chondrinous ;* which, as we have just seen, is also true of the so-called cartilages of the cartilaginous fishes and Cephalopoda.

" The tissue forming the skeleton of these fishes, as I have had opportunities to examine it, is composed of oval or spherical cells like those of common cartilage at an early period. They have become *hardened in situ*, but not calcarified ; and never have I met any having canaliculi radiating from them. From these data we may conclude that in these lower fishes there is *bone-cartilage*, but not true bone."

Professor Agassiz said that he believed naturalists, in considering organic tissues, were altogether too much in the habit of looking at different tissues as if they were entirely distinct bodies, forgetful of the fact that all are derived from one yolk. In considering the first formation of cartilage, we must look to the formation and development of the dorsal cord. We find these cells differing from the blastodermic cells, in being larger, but bearing no resemblance to cartilage-cells, although they form the basis from which the cartilage-cells are built up. He had carefully examined these cells, which, however, presented points of extreme difficulty, but had not yet succeeded in determining whether they were the identical ones which were to be transformed into cartilage-cells, or whether, on the other hand, they were the mother cells, from which the cartilaginous cells would derive their origin.

---

* *Compt. Rend.*, Nov. 25, 1844.

† Poggendorff, *Annalen*, Band XXXVIII. p. 316.

Mr. Agassiz further stated that he had examined the cartilage-like bones of fishes, of which Dr. Burnett had spoken, and that he had found the same results.

Professor Eustis gave an account of a formula for the measure of the solidity of a prismoid, and its application to other cases of mensuration.

The ordinary formula for the area of a prismoid is $\frac{1}{6} h (B + b + 4 M)$, where B and b represent the areas of the upper and lower bases respectively, M the middle section, and h the height. The application of this formula for the mensuration of the sphere and the cone is alluded to in a recent number of the Journal of the Franklin Institute. But still more remarkable cases are those of the paraboloid, hyperboloid, and ellipsoid of revolution, in which the prismoidal formula will be found to give precisely the same results as those obtained by the application of the ordinary formulas from the calculus.

Professor Lovering exhibited a new stereoscope just received, and called the attention of the Academy to some points of detail, especially those arising from the difference of effect when the same drawings of a solid are viewed so as to represent it with one side or its opposite nearest to the eye.

Dr. Burnett commented on these facts, as demonstrating the proposition that the seat of vision is in the brain, and not in the retina.

Dr. B. A. Gould addressed some inquiries to Dr. Burnett concerning the best spider-lines for use in the micrometers of telescopes and microscopes.

A discussion ensued upon the qualities necessary in spider-lines for this purpose, in which Messrs. Burnett, Eustis, and Gould took part.

Dr. Burnett thought that the thread of the Attus or hunting spider was the most desirable in all respects, having almost uniformly a diameter of just $\frac{1}{9000}$ of an inch, and being wholly free from viscosity. The Attus is found at this season of the year on rail fences.

Professor Agassiz presented a paper upon the family of the *Cyprinodonts.*

Three hundred and seventieth meeting.

November 2, 1852. — Monthly Meeting.

The President in the chair.

Professor Felton reminded the Academy of the recent death of the Hon. Daniel Webster, Secretary of State of the United States, and Fellow of this body ; and, after an eloquent tribute to his memory, offered the following resolutions, which, after being seconded by Mr. F. C. Gray, and advocated by Mr. Parsons, were unanimously adopted.

> " *Resolved*, That the Fellows of the American Academy of Arts and Sciences deeply lament the decease of their late Associate, the Hon. Daniel Webster, Secretary of State of the United States. By his death the country is bereaved of her ablest practical statesman, and profoundest political philosopher. Letters and eloquence have lost a most distinguished ornament. Science is deprived of a great and versatile mind, which understood its progress, appreciated its value, recognized its dignity, and mastered its results in the midst of professional labors and public cares, to which his energies were devoted almost to the last moment of his life.
>
> " *Resolved*, That the Fellows of this Academy tender to the family of their late eminent Associate, their most respectful sympathy in this private and public calamity."

Three hundred and seventy-first meeting.

November 10, 1852. — Quarterly Meeting.

The President in the chair.

The Corresponding Secretary laid before the Academy letters from the Royal Society of London, and the Academies of Göttingen, Berlin, Vienna, and Munich, referring to publications forwarded to the Academy.